Home Assignment

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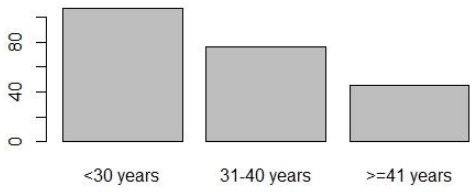
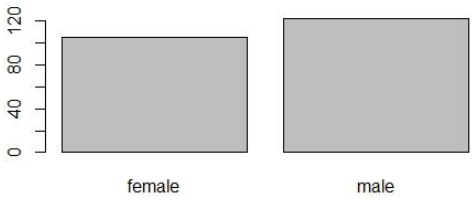
Part 1

#1 The proportion for mostly right-handed is about 0.899 and mostly left-handed is about 0.1.

#2 Writing, Drawing, Throwing, Cutting scissors, Brushing teeth, Cutting.

#3





<30 years	31-40 years	>=41 years	female	male
102	75	41	100	118

The proportion of males is about 54%. It is my understanding that in the general population the proportion is about 51%.

Cell Contents

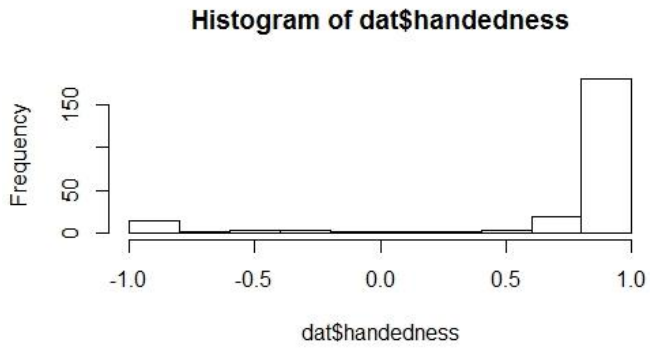
```
|-------------------------|
|                       N |
| Chi-square contribution |
|           N / Row Total |
|           N / Col Total |
|         N / Table Total |
|-------------------------|
```

Total Observations in Table: 218

dat$Right	dat$Age <30 years	31-40 years	>=41 years	Row Total
other	9	8	6	23
	0.288	0.001	0.648	
	0.391	0.348	0.261	0.106
	0.088	0.107	0.146	
	0.041	0.037	0.028	
mostly right-handed	93	67	35	195
	0.034	0.000	0.076	
	0.477	0.344	0.179	0.894
	0.912	0.893	0.854	
	0.427	0.307	0.161	
Column Total	102	75	41	218
	0.468	0.344	0.188	

dat$Right	dat$Sex female	male	Row Total
other	9	14	23
	0.228	0.193	
	0.391	0.609	0.106
	0.090	0.119	
	0.041	0.064	
mostly right-handed	91	104	195
	0.027	0.023	
	0.467	0.533	0.894
	0.910	0.881	
	0.417	0.477	
Column Total	100	118	218
	0.459	0.541	

#4

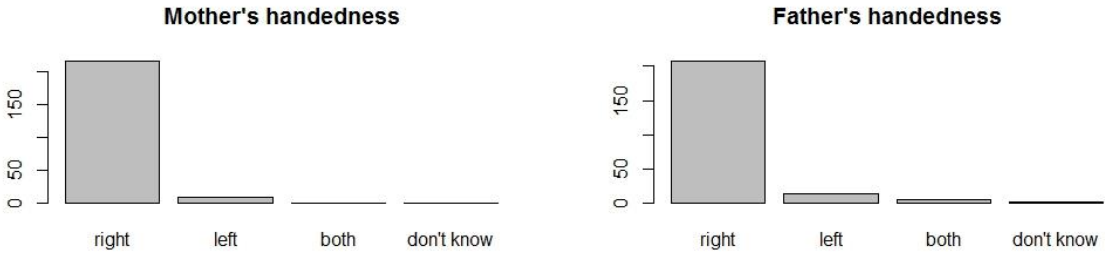


Mean: 0.76

Median: 1

Use median because of skewness.

#5



#6

Correlation: -0.0696

Not correlated.

Part 2

#1

```
Call:
lm(formula = dat$handedness ~ dat$Mothershand + dat$Fathershand)

Residuals:
     Min       1Q   Median       3Q      Max
-1.80849  0.07387  0.19151  0.19151  0.90725

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                 0.80849    0.03776  21.413   <2e-16 ***
dat$Mothershandleft        -0.42743    0.17345  -2.464   0.0145 *
dat$Mothershandboth         0.19151    0.53317   0.359   0.7198
dat$Mothershanddon't know   0.14286    0.75213   0.190   0.8495
dat$Fathershandleft        -0.28830    0.14801  -1.948   0.0527 .
dat$Fathershandboth        -0.26563    0.24082  -1.103   0.2712
dat$Fathershanddon't know   0.04866    0.53317   0.091   0.9274
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.5318 on 220 degrees of freedom
  (1 observation deleted due to missingness)
Multiple R-squared:  0.05381,  Adjusted R-squared:  0.028
F-statistic: 2.085 on 6 and 220 DF,  p-value: 0.05605
```

Intercept is y’s prediction when everything else is zero. If mothers hand is left then the predicted mean score is -0.42 lower than if it was right. If mothers hand is both then the mean score is 0.19 higher than right. If mothers hand is don’t know then the mean score goes up by 0.19 than if it were right. Same interpretations for fathers hand.

```
Call:
lm(formula = dat$handedness ~ dat$Mothershand + dat$Fathershand +
    dat$Sex)

Residuals:
     Min       1Q   Median       3Q      Max
-1.85657  0.03232  0.14343  0.22854  0.96872

Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
(Intercept)                 0.85657    0.05418  15.810   <2e-16 ***
dat$Mothershandleft        -0.44951    0.17427  -2.579   0.0106 *
dat$Mothershandboth         0.22854    0.53411   0.428   0.6692
dat$Mothershanddon't know   0.05775    0.75541   0.076   0.9391
dat$Fathershandleft        -0.29068    0.14800  -1.964   0.0508 .
dat$Fathershandboth        -0.24562    0.24152  -1.017   0.3103
dat$Fathershanddon't know   0.08568    0.53411   0.160   0.8727
dat$Sexmale                -0.08511    0.07197  -1.183   0.2383
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.5317 on 218 degrees of freedom
  (2 observations deleted due to missingness)
Multiple R-squared:  0.06049,  Adjusted R-squared:  0.03032
F-statistic: 2.005 on 7 and 218 DF,  p-value: 0.05567
```

Everything else being constant, if the sex is male then the mean score is -0.085 lower than if the sex was female. Some change in the coefficients can be seen and the R-squared value improves a bit.

#2

```
Call:
lm(formula = dat$handedness ~ dat$Theory)

Residuals:
     Min       1Q   Median       3Q      Max
-1.78529  0.09706  0.21471  0.24992  0.24992

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    0.75008    0.05165  14.523   <2e-16 ***
dat$Theoryyes  0.03522    0.07149   0.493    0.623
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.5392 on 226 degrees of freedom
Multiple R-squared:  0.001073, Adjusted R-squared:  -0.003347
F-statistic: 0.2427 on 1 and 226 DF,  p-value: 0.6228
```

The intercept value of 0.75 means that the score is 0.75 if theory is no. If Theory is yes then the mean value of the score is 0.035 higher than if theory was no.

#3

```
Call:
lm(formula = dat$handedness ~ dat$Theory + dat$Skills)

Residuals:
    Min      1Q  Median      3Q     Max
-1.7853  0.0921  0.2147  0.2171  0.2846

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    0.71540    0.07416   9.647   <2e-16 ***
dat$Theoryyes  0.06990    0.08916   0.784    0.434
dat$Skillsyes  0.06750    0.10346   0.652    0.515
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.5399 on 225 degrees of freedom
Multiple R-squared:  0.002959, Adjusted R-squared:  -0.005904
F-statistic: 0.3338 on 2 and 225 DF,  p-value: 0.7165
```

Everything else being constant, if skill is yes then the mean score is 0.067 higher than if skill was no. Both have a high p-value and low coefficient estimates. Neither seems to be related to the score.

```
confint(logistic_model4)
Waiting for profiling to be done...
                   2.5 %   97.5 %
(Intercept)    1.2880540 3.018129
dat$Theoryyes -0.9773176 1.167055
dat$Skillsyes -1.1844280 1.267882
```

Confidence intervals of different parameters containing 0 imply that there is not a statistically significant difference between the classes.

#4

```
Call:
glm(formula = Right_handed ~ Mothershand + Fathershand, family = "binomial",
    data = dat)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.2191   0.4222   0.4222   0.4222   1.2751

Coefficients:
                         Estimate Std. Error z value Pr(>|z|)
(Intercept)             2.373e+00  2.578e-01   9.206   <2e-16 ***
Mothershandleft        -1.376e+00  7.754e-01  -1.775   0.0759 .
Mothershandboth         1.419e+01  2.400e+03   0.006   0.9953
Mothershanddon't know   2.798e-11  3.393e+03   0.000   1.0000
Fathershandleft        -1.224e+00  6.634e-01  -1.844   0.0651 .
Fathershandboth        -9.867e-01  1.147e+00  -0.860   0.3898
Fathershanddon't know   1.419e+01  2.400e+03   0.006   0.9953
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

The logistic regression coefficients give the change in the log odds of the outcome for a one unit change in the predictor variable. For a change from Motherhandright to Motherhandleft, the log odds of being Right-handed(versus other) decreases by -1.38. For a change from Motherhandright to Motherhandboth, the log odds of being Right-handed(versus other) decreases by 1.419. To interpret the coefficients as odds ratios, you have to exponentiate them.

```
round(exp(coef(logistic_model1)[2]),3)
Mothershandleft
          0.253
```

Now we can say that for a change from Motherhandright to Mothershandleft, the odds of being right-handed (versus other) is 25% less.

```
Call:
glm(formula = dat$Right_handed ~ dat$Mothershand + dat$Fathershand +
    dat$Sex, family = "binomial")

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.3145   0.3772   0.4576   0.4576   1.3928

Coefficients:
                           Estimate Std. Error z value Pr(>|z|)
(Intercept)                  2.6074     0.3899   6.688 2.27e-11 ***
dat$Mothershandleft         -1.4656     0.7902  -1.855   0.0636 .
dat$Mothershandboth         14.3622  2399.5447   0.006   0.9952
dat$Mothershanddon't know   -0.4035  3393.4687   0.000   0.9999
dat$Fathershandleft         -1.2316     0.6682  -1.843   0.0653 .
dat$Fathershandboth         -0.8906     1.1539  -0.772   0.4402
dat$Fathershanddon't know   14.3622  2399.5447   0.006   0.9952
dat$Sexmale                 -0.4035     0.4703  -0.858   0.3909
```

For a change from Sexfemale to Sexmale, the log odds of being Right-handed(versus other) decreases by -0.4.

```
Call:
glm(formula = dat$Right_handed ~ dat$Theory, family = "binomial")

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.1460   0.4590   0.4590   0.4854   0.4854

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)     2.0794     0.3062   6.792 1.11e-11 ***
dat$Theoryyes   0.1178     0.4413   0.267     0.79
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

For a change from Theoryno to Theoryyes, the log odds of being Right-handed(versus other) increases by 0.1178.

```
Call:
glm(formula = dat$Right_handed ~ dat$Theory + dat$Skills, family = "binomial")

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.1460   0.4590   0.4590   0.4807   0.4902

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)    2.05839    0.43352   4.748 2.05e-06 ***
dat$Theoryyes  0.13884    0.53752   0.258    0.796
dat$Skillsyes  0.04167    0.61237   0.068    0.946
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

For a change from Skillno to Skillyes, while holding Theory at a constant level, the log odds of being Right-handed(versus other) increases by 0.0417.

#5

Only 2 people in this sample have a left-handed mother and father, 1 of which is mostly left-handed.

The odds are 1.009217, so about 1% better.

#6

The data seems good for this purpose.